STRUCTURE CONNECTING HEAT EXCHANGER TO SHROUD IMPROVING WORKABILITY IN ASSEMBLING OR DISASSEMBLING THEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a structure connecting a shroud to a heat exchanger in order to fix an air blower to the heat exchanger, and is effective when applied to a vehicle.

2. Description of the Related Art

Conventionally, after a radiator and a shroud were fixed to a vehicle-mounting bracket, a module into which the radiator and the shroud (including an air blower) had been integrated was assembled to a vehicle (for example, refer to Patent Reference 1.)

[Patent Reference 1]

Japanese Unexamined Patent Publication (Kokai) No. 11-142084

According to the invention described in Patent Reference 1, however, it is necessary to fix a shroud to a bracket after fixing the bracket to a radiator, and this does not necessarily provide good workability in assembly and disassembly.

SUMMARY OF THE INVENTION

The present invention has been developed with the above-mentioned problems being taken into consideration, and the first object thereof is to provide a structure connecting a shroud to a heat exchanger, which is novel and different from the prior art. The second object is to improve the workability while assembling or disassembling a heat exchanger and a shroud.

To realize the above-mentioned objects, according to a first aspect of the present invention, a structure for assembling a heat exchanger (1) and a shroud (4) comprises: an air blower (5) that sends a current of air to the heat exchanger (1); the shroud (4) that guides the

current of air sent from the air blower (5) to the heat exchanger (1); and brackets (3) for mounting the heat exchanger (1) to a vehicle body; wherein the brackets (3) and the shroud (4) are pressed by part of the vehicle body and prevented from moving in the vertical direction in a state in which the horizontal movement of the shroud (4) with respect to the brackets (3) is prevented by projections (3b) that are formed on the top end sides of the brackets (3) and project upward, and the bottom end side of the shroud (4) is supported by support projections (3j) provided to the bracket (3).

In this way, it is possible to easily assemble the heat exchanger (1) and the shroud (4) because the shroud (4) is assembled to the heat exchanger (1) in such a way that the shroud (4) covers the brackets (3) that have been assembled to the heat exchanger (1) and, at the same time, the shroud (4) is prevented from being detached from the brackets (3) by the vehicle body.

Therefore, it is possible to improve the workability in assembling or disassembling the heat exchanger (1) and the shroud (4).

According to a second aspect of the present invention, a structure connecting a shroud (4) to a heat exchanger (1) comprises: an air blower (5) that sends a current of air to the heat exchanger (1); and the shroud (4) that guides the current of air sent from the air blower (5) to the heat exchanger (1); wherein the heat exchanger (1) and the shroud (4) are pressed by part of a vehicle body and prevented from moving in the vertical direction in a state in which the horizontal movement of the shroud (4) with respect to the heat exchanger (1) is prevented by projections (3b) that are formed on the top end side of the heat exchanger (1) and project in a vertical direction, and the bottom end side of the shroud (4) is supported by support projections (3j) provided to the heat exchanger (1).

In this way, it is possible to easily assemble the

heat exchanger (1) and the shroud (4) because the shroud (4) is assembled to the heat exchanger (1) in such a way that the shroud (4) covers the heat exchanger (1) and, at the same time, the shroud (4) is prevented from being detached from the brackets (3) by the vehicle body.

Therefore, it is possible to improve the workability in assembling or disassembling the heat exchanger (1) and the shroud (4).

According to a third aspect of the present invention, a structure connecting a shroud (4) to a heat exchanger (1) comprises: an air blower (5) that sends a current of air to the heat exchanger (1); the shroud (4) that guides the current of air sent from the air blower (5) to the heat exchanger (1); and brackets (3) for mounting the heat exchanger (1) to a vehicle body; wherein the brackets (3) and the shroud (4) are prevented from moving in the vertical direction by tightening-coupling means (3h) provided at least to either of the brackets (3) or the shroud (4) in a state in which the horizontal movement of the shroud (4) with respect to the brackets (3) is prevented by projections (3b) that are formed on the top end sides of the brackets (3) and project upward, and the bottom end side of the shroud (4) is supported by support projections (3j) provided to the brackets (3).

In this way, it is possible to easily assemble the heat exchanger (1) and the shroud (4) because the shroud (4) is assembled to the heat exchanger (1) in such a way that the shroud (4) covers the brackets (3) that have been assembled to the heat exchanger (1) and, at the same time, the shroud (4) is prevented from being detached from the brackets (3), by the tightening-coupling means (3h).

Therefore, it is possible to improve the workability in assembling or disassembling the heat exchanger (1) and the shroud (4).

According to a fourth aspect of the present

invention, a structure connecting a shroud (4) to comprises: an air blower (5) that sends a current of air to the heat exchanger (1); and the shroud (4) that guides the current of air sent from the air blower (5) to the heat exchanger (1); wherein the heat exchanger (1) and the shroud (4) are pressed by tightening-coupling means (3h) provided to the heat exchanger (1) and are prevented from moving in the vertical direction in a state in which the horizontal movement of the shroud (4) with respect to the heat-exchanger (1) is prevented by projections (3b) that are formed on the top end side of the heat exchanger (1) and project in a vertical direction, and the bottom end side of the shroud (4) is supported by support projections (3j) provided to the heat exchanger (1).

In this way, it is possible to easily assemble the heat exchanger (1) and the shroud (4) because the shroud (4) is assembled to the heat exchanger (1) in such a way that the shroud (4) covers the heat exchanger (1) and, at the same time, the shroud (4) is prevented from being detached from the brackets (3) by the tightening-coupling means (3h).

Therefore, it is possible to improve the workability in assembling or disassembling the heat exchanger (1) and the shroud (4).

In a fifth aspect of the present invention, the tightening-coupling means (3h) have at least an engaging-stopping projection that can displace elastically.

In a sixth aspect of the present invention, the brackets (3) are provided with projections (3b) and the shroud (4) is provided with insertion holes (4a) into which the projections (3b) are inserted.

In a seventh aspect of the present invention, plural heat exchangers (1, 2) are assembled to the brackets (3) so as to sandwich the brackets.

In an eighth aspect of the present invention, the shroud (4) has a substantially L-shaped section which comprises: a top end portion that is assembled to

projections of the brackets (3) (or the heat exchanger (1)); and an air guide portion that supports the air blower (5) and guides the current of air that has passed through the heat exchanger to the air blower (5).

The symbols within the brackets that follow each components described above are an example of the correspondence with concrete components that will be described later in the description of the preferred embodiments.

The present invention may be more fully understood from the description of the preferred embodiments of the invention set forth below, together with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG.1 is a perspective view of a cooling module according to a first embodiment of the present invention.

FIG.2 is an enlarged view of part A in FIG.1

FIG.3 is a front view of a bracket according to an embodiment of the present invention.

FIG.4 is an explanatory view of the assembly of the cooling module according to the first embodiment of the present invention.

FIG.5 is an explanatory view of the assembly of the cooling module according to the first embodiment of the present invention.

FIG.6 is an explanatory view of the assembly of the cooling module according to the first embodiment of the present invention.

FIG.7 is an explanatory view of the assembly of the cooling module according to the first embodiment of the present invention.

FIG.8 is an explanatory view of the assembly of the cooling module according to the first embodiment of the present invention.

FIG.9 is an explanatory view of the assembly of the cooling module according to the first embodiment of the

present invention.

FIG.10 is an explanatory view of the assembly of the cooling module according to the first embodiment of the present invention.

FIG.11 is an explanatory view of the assembly of the cooling module according to the first embodiment of the present invention.

FIG.12 is a perspective view showing the characteristics of a radiator and a fan shroud according to a second embodiment of the present invention.

FIG.13 is an explanatory view of the assembly of the radiator and the fan shroud according to the second embodiment of the present invention.

FIG.14 is an explanatory view of the assembly of the radiator and the fan shroud according to the second embodiment of the present invention.

FIG.15 is an explanatory view of the assembly of the radiator and the fan shroud according to the second embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

(First embodiment)

In the present embodiment, the structure connecting a shroud to a heat exchanger according to the present invention is applied to a structure for assembling a cooling module into which an on-board radiator and an outdoor heat exchanger, which is located outside an air-conditioned compartment, of an on-board air conditioning system have been integrated.

FIG.1 is a perspective view of a cooling module viewed from the downstream side of a current of air, and FIG.2 is an enlarged view of part A shown in FIG.1.

A radiator 1 cools cooling water that circulates through an engine by exchanging heat between the cooling water and the air, and a condenser 2 (refer to FIG.1) cools and condenses a high-pressure refrigerant discharged from a compressor.

The radiator 1 and the condenser 2 have a

substantially identical structure, in concrete terms, comprising: a core section 1c comprising a plurality of tubes 1a, through which fluid, i.e., cooling water in the case of the radiator 1 and refrigerant in the case of the condenser 2, etc. flows and fins 1b that are joined to the outer surfaces of the tubes and increase the heat transferring area through which heat is transferred to the outside air; header tanks 1d that are communicated with the plurality of tubes 1a at both ends in the direction of the length of the tubes 1a and that extend in the direction substantially perpendicular to the direction of the length of the tubes 1a; inserts 1e that are located at the ends of the core section 1c, extend in the direction parallel to the direction of the length of the tubes 1a, and reinforce the core section 1c; and so on, as shown in FIG.1; and in the present embodiment, all of these components are made of aluminum alloy and are integrated into one unit by brazing.

Because the core section of the condenser 2 is not shown in FIG.1, the symbols of the tubes, fins, a core section, header tanks and inserts are only those relating to the radiator 1.

"Brazing" is a technique to join two pieces of metal by using a brazing filler metal or solder without melting a base metal, according to, for example, "Bonding and Joining Technique", published by Tokyo Denki University Press. In general, joining work which is done by using a filler metal whose melting point is above 450 °C is called brazing, and the filler metal is called a brazing filler metal, and when a filler metal whose melting point is below 450 °C is used for joining, it is called soldering and the filler metal is called a solder.

The radiator 1 and the condenser 2 are arranged in such a way that core sections 1c thereof are parallel, i.e. one of the core surface of the radiator 1 is opposed to that of the condenser 2, and there is a fixed gap

between the respective core sections 1c, and, at the same time, they are fixed to brackets 3 that are arranged so as to be sandwiched between the radiator 1 and the condenser 2 as shown in FIG.2, and they are attached to a vehicle body via the brackets 3.

The bracket 3 comprises a bracket main body 3a, mounting pins 3b, mounting stays 3c, reinforcing parts 3d, and so on, as shown in FIG.3, and these components 3a to 3d are integrally formed into one unit by using a resin (for example, nylon containing glass fiber).

The bracket main body 3a is a thin rectangular and extends in the vertical direction at the portions corresponding to the header tank 1d of the radiator 1 and the header tank of the condenser 2, that is, the positions corresponding to the ends of the radiator 1 and the condenser 2, and the mounting stays 3c are thin rectangular plate shape are provided at the top and bottom ends of the bracket main body 3a, and project toward the core sections of the radiator 1 and the condenser 2 from the bracket main body 3a.

The mounting stays 3c are provided with the mounting pins 3b for assembling the cooling module, that is, the radiator 1 and the condenser 2 integrated into one unit by the brackets 3, to the vehicle body, and the mounting pins 3b are pin-shaped projections that project upward and downward from the mounting stays 3c. The reinforcing part 3d has a substantially triangular shape and is attached to the base side of the mounting stay 3c to support the moment produced at the junction of the mounting stay 3c and the bracket main body 3a, and a plurality of holes 3e are provided in the reinforcing part 3d in such a way that the hole penetrates through the reinforcing part 3d in the direction perpendicular to the core surface, that is, in the direction in which air should flow.

In the present embodiment, by forming the holes 3e into a substantially triangular shape, the reinforcing

part 3d has a truss structure and the strength thereof is prevented from being considerably reduced.

As shown in FIG.5, the top end side of the radiator 1 is fixed to the brackets 3 by inserting snap fits 3f provided to the brackets 3 into holes 1f provided in the insert 1e, and the bottom end side thereof is fixed to the brackets 3 by inserting projections 3g formed on the bottom end sides of the brackets 3 into a recess, which is formed by making the section of the insert 1e into a substantially reversed-C shape, as shown in FIG.6.

The snap fit 3f is a tightening-coupling means for detachably tightening, coupling, and fixing two members by utilizing the elastic deformation of projections formed into a hook-shape and, in the present embodiment, the snap fits 3f are integrally formed with the bracket 3.

The top end side of the condenser 2 is fixed to the brackets 3 by inserting parts of the brackets 3 into the insert 2e, as shown in FIG.4, and the bottom end side thereof is fixed to the brackets 3 by inserting the projections 3g into the recess of the insert 2e, as similar to the radiator 1 (refer to FIG.6).

The top end side of a fan shroud 4 is prevented from moving with respect to the brackets 3 in the horizontal direction by inserting the mounting pins 3b into holes 4a (refer to FIG.9 and FIG.10) formed in the fan shroud 4, as shown in FIG.7 and FIG.8 and, at the same time, it is pressed by an upper member or a radiator support 6 which is a part of the vehicle body, as shown in FIG.11, and the movement of the fan shroud 4 in the vertical direction is prevented.

In the present embodiment, in addition to the radiator support 6 that presses the fan shroud 4, the brackets 3 are provided with snap fits 3h that engage with the fan shroud 4 and fix the brackets 3 and the fan shroud 4 and, in addition to the case where the cooling module has been assembled to a vehicle, the fan shroud 4

is prevented from shifting from the proper position with respect to the brackets 3 in the case where the cooling module is not yet assembled to a vehicle, for example, while it is being transported.

On the other hand, the top end side of the fan shroud 4 is supported by support projections 3j provided to the brackets 3, as shown in FIG.9 and FIG.10. The support projection 3j has an umbrella-shaped flange at the front end side and the fan shroud 4 is prevented from moving downward and in the horizontal direction by inserting the support projections 3j into recess-shaped slots 4b (refer to FIG.9) provided in the fan shroud 4.

The object of the fan shroud 4 is to support an air blower 5 (refer to FIG.9) that sends a current of cooling air to a heat exchanger such as the radiator 1 and, in the present embodiment, it has, in addition to the function as a support member, a function to prevent a current of air produced by the air blower 5 from flowing so as to skirt the air blower 5 and the radiator 1 by covering the gap between the air blower 5 and the radiator 1.

Next, the procedure of assembling the cooling module is described below.

First the condenser 2 and the brackets 3 are assembled in such a way that the brackets 3 are inserted into the condenser 2 (refer to FIG.4), and then the radiator 1 is assembled to the brackets 3 (refer to FIG.5).

Next, the fan shroud 4 is assembled to the cooling module from above in such a way that the mounting pins 3b are inserted into the holes 4a (refer to FIG.9 and FIG.10), and, then, the cooling module, to which the fan shroud 4 has been assembled, is assembled to a vehicle (FIG.11).

The bottom end side of the cooling module is fixed by inserting the mounting pins 3b into mounting holes of the vehicle body, and the top end side thereof is fixed

in such a way that the top end side is pressed from above by brackets 6a of the vehicle body (FIG.11).

Next, the effects of the present embodiment are described.

In the present embodiment, it is possible to easily assemble the cooling module and the fan shroud 4 because the fan shroud 4 is assembled to the cooling module in such a way that the fan shroud 4 covers the brackets 3 that have been assembled to the cooling module, that is, the radiator 1 and the condenser 2 and, at the same time, the snap fits 3h and the vehicle body prevent the fan shroud 4 from being detached from the brackets 3.

Accordingly, it is possible to improve the workability in assembling or disassembling the cooling module and the fan shroud 4.

(Second embodiment)

Although the vehicle-mounting pins 3b are provided to the brackets 3 in the first embodiment, in the present embodiment, the mounting pins 3b and the snap fits 3h are provided to the header tank 1d of the radiator 1 at the upper side thereof and the support projections 3j are provided to the header tank 1d of the radiator 1 at the lower side thereof, as shown in FIG.12.

In the present embodiment, the header tank 1d is made of resin (for example, nylon containing glass fiber), and the mounting pins 3b, the snap fits 3h, and the support projections 3j are integrally formed to the header tanks 1d.

When assembled to the radiator 1, the fan shroud 4 is assembled to the cooling module from above in such a way that the mounting pins 3b are inserted into the holes 4a (refer to FIG.13 and FIG.14), similar to the first embodiment and, then, the cooling module, to which the fan shroud 4 has been assembled, is assembled to a vehicle body (FIG.15).

(Other embodiments)

In the first embodiment, the bracket main body 3a,

the mounting pins 3b, the mounting stays 3c and the reinforcing sections 3d are integrally formed by resin, but the present invention is not limited to this and, for example, they may be made of metal by a press or by die-casting.

In the first and second embodiments described above, the movement of the fan shroud 4 in the vertical direction is prevented by the snap fits 3h and the vehicle body, but the present invention is not limited to this, and the movement of the fan shroud 4 in the vertical direction may be prevented by either the snap fits 3h or the vehicle body.

Although in the first embodiment the present invention is applied to a heat exchanger module, into which different kinds of heat exchangers have been integrated by brackets, it is needless to say that the present invention can also be applied to a structure for connecting, for example, only the radiator 1 to the fan shroud 4.

In the second embodiment, the structure is for connecting only the radiator 1 to the fan shroud 4, but it is needless to say that the structure can also be applied to, for example, a heat exchanger module, into which different kinds of heat exchangers have been integrated by brackets.

The snap fits 3h are used as tightening-coupling means for preventing the movement in the vertical direction in the embodiments described above but the present invention is not limited to this and, for example, bolts may be used instead.

Although the snap fits 3h are provided to the brackets 3 or the radiator 1 in the embodiments described above, on the contrary, tightening-coupling means, such as the snap fits 3h, may be provided on the fan shroud 4.

While the invention has been described by reference to specific embodiments chosen for the purposes of illustration, it should be apparent that numerous

modifications could be made thereto by those skilled in the art without departing from the basic concept and scope of the invention.